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THE ICE CREAM AND FROZEN DESSERT INDUSTRY— CHANGES AND CHALLENGES

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JUN 4 1963

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Bulletin 694

University of Illinois Agricultural Experiment Station

Sources for Tables and Figures

Table 1. Dairy Statistics Through 1960, Stat. Bul. 303, Econ. Res. Serv., U.S. Dept. Agr., pp. 200-203; Production of Manufactured Dairy Products, 1961, USDA, p. 21; population data from Statistical Abstract of the United States, 1951 and 1961 eds., and from Current Population Reports, Population Estimates, Series P-25, No. 239.

Table 2. USDA Stat. Bul. 303, pp. 202-203; and Production of Manufactured Dairy Products, USDA, publications for 1952 through 1961.

Table 3. Production of Manufactured Dairy Products, USDA, publications for 1952 through 1961.

Fig. 1. USDA Stat. Bul. 303, pp. 333-335.

Fig. 2. USDA Stat. Bul. 303, pp. 200-203 and p. 380; data for 1961 from Dairy Situation, Nov. 1961.

Fig. 3. USDA Stat. Bul. 303, pp. 200-203.

Fig. 4. USDA Stat. Bul. 303, pp. 231-233; Production of Manufactured Dairy Products, USDA, publications for 1952 through 1961; for population data see source for Table 1.

Fig. 5. The Economic Almanac 1962, National Industrial Conference Board, p. 104; for per capita consumption data see source for Table 1.

Fig. 6. Ice Cream Trade Journal, 52(8):16, 1956; and Ice Cream Field, 79(2):17, 1962.

Fig. 7. Ice Cream Trade Journal, 53(12):13, 1957; and Ice Cream Field, 79(2):15-20, 1962.

Fig. 8. USDA Stat. Bul. 303, p. 195.

Fig. 9. USDA Stat. Bul. 303, p. 196.

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Definitions of Terms

ICE CREAM: a high-butterfat frozen dairy dessert. Federal standards for plain (vanilla) ice cream require minima of 10 percent milkfat and 20 percent total milk solids. When fruit, nuts, or bulky flavorings are used, the figures are 8 and 16 percent, respectively. The finished gallon of ice cream must weigh 4.5 pounds and contain 1.6 pounds of food solids.

ICE MILK: a low-fat ice cream. Under federal standards milkfat content must be at least 2 percent but not more than 7 percent. The minimum for total milk solids is 11 percent. Minimum weight per gallon is 4.5 pounds, including 1.3 pounds of food solids. Twenty-eight states require a higher minimum fat content; 13 allow a higher maximum, usually 8 or 10 percent; and 14 states specify a higher milk solids minimum, usually 14 percent.

MILK SHERBET: a low-fat, low-milk-solids frozen dairy dessert. Federal standards limit both minimum and maximum for milkfat content (1 to 2 percent) and for total milk solids (2 to 5 percent). Acid content minimum is 0.35 percent and minimum gallon weight is 6 pounds. More than half the states specify limits for milk solids, but not for milkfat.

OTHER FROZEN DAIRY DESSERTS: mostly frosted malted milk, which some states classify as ice milk, and frozen custard. Federal standards for frozen custard are the same as for ice cream except that egg yolk solids content of not less than 1.4 percent is required. Eighteen states specify number of yolks, usually five dozen per 90 pounds.

MELLORINE: a vegetable- or animal-fat frozen dessert. Although it contains nonfat milk solids, mellorine is not considered a dairy product because its principal ingredients are not dairy products. It contains no butterfat. About 85 percent of the mellorine made uses soybean or cottonseed oil as the fat constituent and about equal amounts of the two are used. Other fats used include coconut oil, corn oil, peanut oil, and meat fats. There are no federal standards for mellorine. However, the American Meat Institute has proposed specifications that are similar to federal standards for ice cream: 10 percent fat and 20 percent total food solids for plain mellorine; 8 and 16 percent, respectively, for bulky flavored product; 4.5-pound gallon. Of twelve mellorine-permitting states, five are largely in agreement with the recommendations, three allow lower fat content, and four have no production standards. Most of the mellorine manufactured actually contains 8 percent fat.

WATER ICES: water-base, nondairy frozen desserts. They contain no milk products but are about 65 percent water, the other ingredients being sucrose, glucose, stabilizer, and flavoring. The distinguishing characteristics are tart flavor, low overrun, and low melting point. Federal standards require at least 2 percent fruit ingredients for citrus ices, 6 percent for berry ices, and 10 percent for all other fruit ices. Acid content and minimum weight per gallon are the same as for sherbet.

Except where noted otherwise, most state standards are in general agreement with federal standards, adopted in October 1960 for regulation of products shipped interstate.

THE ICE CREAM AND FROZEN DESSERT INDUSTRY — CHANGES AND CHALLENGES

ROBERT E. JACOBSON and ROLAND W. BARTLETT¹

COMMERCIAL PRODUCTION OF FROZEN DESSERTS began in 1851 when the nation's first wholesale ice cream business was opened in Baltimore. Today frozen desserts are a nationwide industry. Plants operating in 48 states² are producing nearly a billion gallons of frozen desserts, and consumption is approaching 5.5 gallons per capita.

Frozen dessert production is essentially associated with concentrated population areas rather than with areas of surplus milk production. In 1961 New York ranked first in production of ice cream and water ices; California led in production of sherbet and ice milk; and Texas was the major mellorine-producing state. In production of all frozen desserts, the leaders were California, Pennsylvania, New York, Illinois, and Ohio, in that order.

During the past quarter-century, the number of plants manufacturing ice cream has declined by 62 percent, but average plant capacity has increased more than sixfold. In 1938 there were 5,003 wholesale ice cream plants averaging 54,000 gallons per year; in 1961 there were 1,904 plants averaging 342,600 gallons per year.

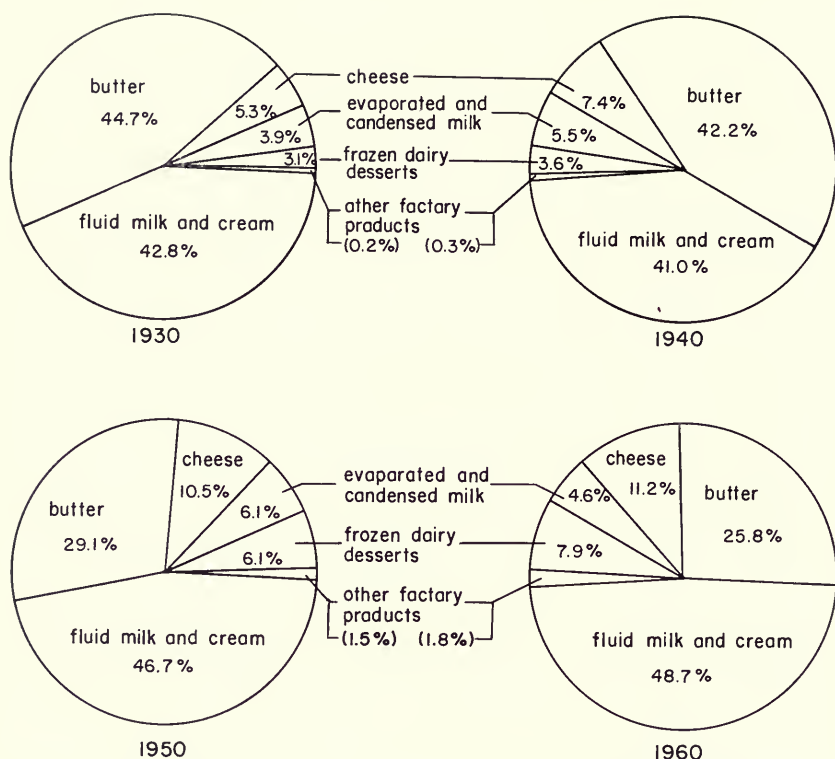
The growth of the frozen dessert industry is reflected not only in increased plant capacity and total production but also in the increasing proportion of the total milk supply being diverted to the manufacture of frozen dairy products. In 1930, 3.1 percent or 353.5 million gallons of milk went into frozen dairy products; in 1960 the figures were 7.9 percent and 1,100.3 million gallons (Fig. 1).³ No other major dairy product, with the exception of cheese, has even approached this growth rate.

Consumption rates for other higher butterfat items — butter and cream — are declining steadily and are now at the lowest points seen in more than 30 years (Fig. 2). Evaporated whole milk also has fallen below the 1929 level. Fluid milk is now stable at a level slightly above that maintained in the years before World War II. In contrast, cheese

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² Data in this bulletin do not include those for Alaska and Hawaii.

³ Figures are based on milk used for human consumption, which accounts for 97 to 98 percent of the total supply.



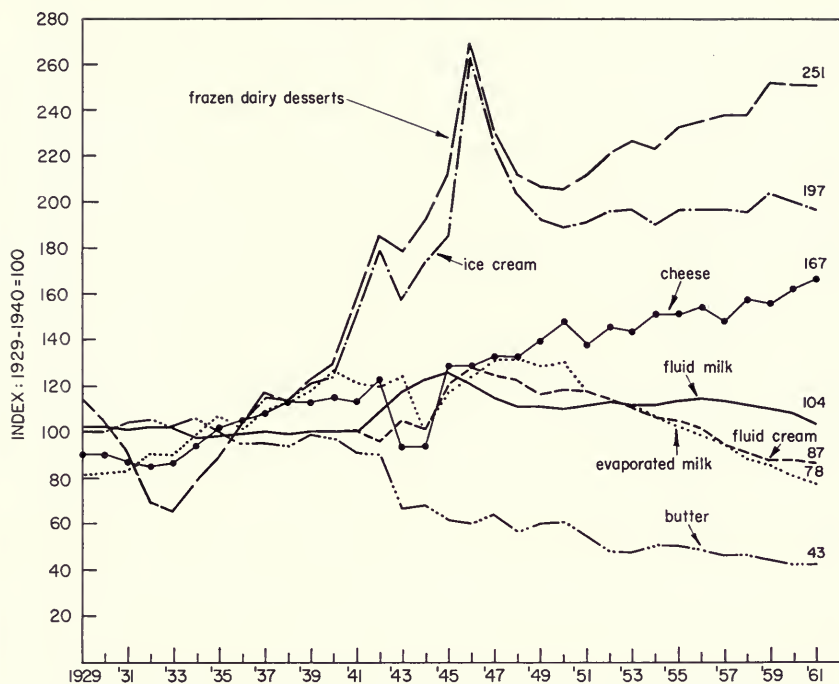
Utilization of milk in products for human consumption, United States. (Fig. 1)

has been growing steadily, and in 1960 per capita sales were about 80 percent above those of 1930. The most spectacular increase, however, has been in frozen dairy products, where per capita consumption has more than doubled since 1930. Thus from the viewpoint of the market for milk solids, frozen dairy desserts have been the strongest sector in the dairy industry.

The erratic pattern of per capita consumption seen in frozen dairy desserts between 1929 and 1960 is largely due to changes in consumption of ice cream, which has always been and still is the major item upon which the entire frozen dessert industry rests.

Ice cream consumption decreased sharply during the depression period 1929-1933 and then rose rapidly until the war years 1943-1945, when butterfat and total milk solids were rationed.

War Price Board Regulation M-271, issued in December 1942, restricted total milk solids used by the frozen dairy industry to 60 per-



Per capita consumption of the principal dairy products, United States. (Fig. 2)

cent of the amount used in October 1942. War Food Order No. 8 replaced this regulation in February of 1943 and limited milk solids usage to 65 percent of the December 1941-December 1942 base period level, exclusive of amounts used for the armed forces.

When this final restriction was removed, September 1, 1945, ice cream production and consumption increased to record levels.

Per capita consumption of ice cream fell sharply after 1946 and reached a postwar low of 3.67 gallons in 1950. Since that year ice cream production has increased by about 150 million gallons, and per capita consumption has climbed slowly and steadily.

The Rise of New Products

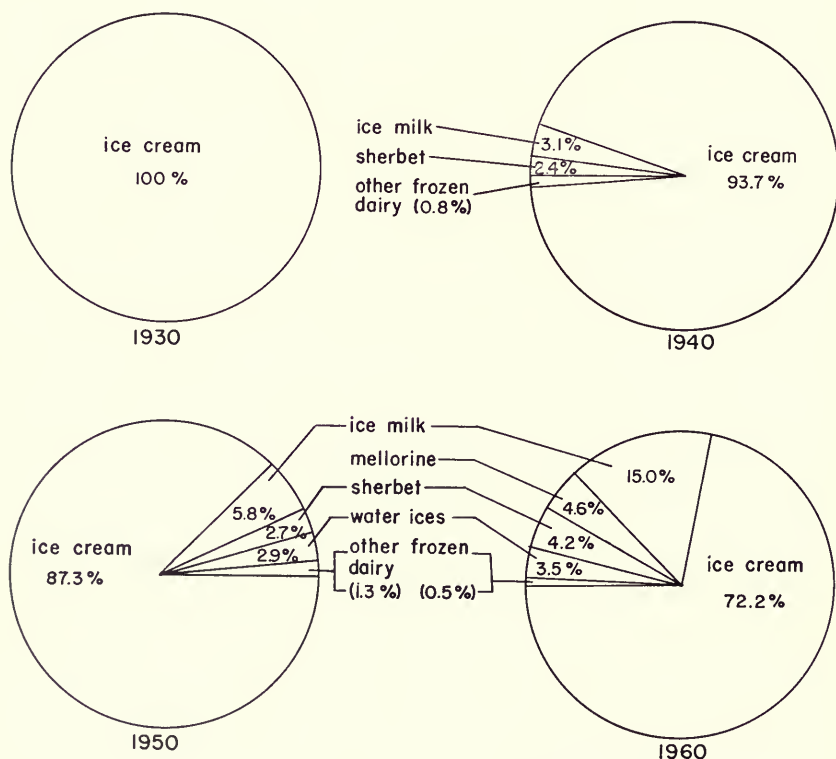
In the past decade, products other than ice cream have come to play a very important role in the frozen dessert industry. Since 1950, for example, the new products — ice milk, sherbet, other frozen dairy desserts, mellorine, and water ices — have been responsible for 80 percent of the rise in per capita consumption of all frozen desserts. Ice

cream itself, which represented an average of 80 percent of the total frozen dessert market during this period, was responsible for only 20 percent of the per capita consumption increase.

The growing influence of new products (Fig. 3) has been in progress since 1932, when more than 2 million gallons of milk sherbet were reported in the marketplace (Table 1). Production data for ice milk were first recorded in 1940, for water ices in 1949. Mellorine was first manufactured in 1942, but production figures were not recorded until 1952.

Ice milk most popular new product

Ice milk was just establishing itself in the market when the restrictions of World War II caused a slight decrease in production. Since that time, however, sales of ice milk have increased rapidly. This frozen dairy dessert is now second only to ice cream in per capita



Proportion of total frozen dessert gallonage accounted for by ice cream and other individual frozen desserts, United States. (Fig. 3)

Table 1. — Production and Consumption of Frozen Dairy Desserts, Water Ice, and Mellorine, United States, 1929-1961

Year	All frozen desserts			Ice cream			Sherbet			Ice milk			Other frozen dairy products			Water ice			Mellorine		
	Total	Per capita	gallons	million gallons	Total	Per capita	million gallons	Total	Per capita	million gallons	Total	Per capita	million gallons	Total	Per capita	million gallons	Total	Per capita	million gallons	Total	Per capita
1929.....	277.2	2.28	277.2	2.28																	
1930.....	255.4	2.08	255.4	2.08																	
1931.....	226.4	1.83	226.4	1.83																	
1932.....	170.2	1.36	168.0	1.35			2.2		.02												
1933.....	163.7	1.30	161.8	1.29			2.0		.02												
1934.....	194.8	1.52	191.6	1.52			3.54		.03												
1935.....	222.7	1.75	219.1	1.72			3.6		.03												
1936.....	263.9	2.06	258.6	2.02			5.3		.04												
1937.....	297.0	2.31	291.1	2.26			6.0		.05												
1938.....	292.4	2.25	286.4	2.21			6.0		.05												
1939.....	319.6	2.44	305.8	2.34			13.8		.11												
1940.....	339.5	2.57	318.1	2.41			8.1		.06				2.9	.02							
1941.....	414.9	3.12	390.3	2.93			8.1		.06				4.1	.03							
1942.....	491.5	3.67	464.2	3.47			8.8		.07				4.6	.03							
1943.....	474.3	3.53	411.6	3.07			47.2		.35				10.0	.08							
1944.....	507.4	3.82	444.9	3.35			49.5		.37				8.4	.06							
1945.....	560.5	4.23	477.2	3.60			65.2		.49				6.5	.05							
1946.....	746.7	5.33	713.8	5.10			12.0		.09				5.6	.04							
1947.....	662.6	4.62	631.0	4.40			10.5		.07				5.5	.04							
1948.....	613.0	4.20	576.5	3.95			12.2		.08				5.0	.03							
1949.....	626.6	4.22	558.1	3.75			13.6		.09				6.8	.05		18.7	.13				
1950.....	634.8	4.20	554.4	3.67			17.0		.11				8.2	.05		18.3	.12				
1951.....	665.7	4.34	568.8	3.71			20.5		.13				8.9	.06		21.7	.14				
1952.....	718.7	4.61	592.7	3.81			25.6		.16				9.2	.06		26.3	.17		11.2	.07	
1953.....	761.1	4.81	605.1	3.82			31.1		.20				9.2	.06		26.9	.17		24.2	.19	
1954.....	773.7	4.80	596.8	3.70			34.2		.21				4.8	.03		26.6	.16		31.4	.19	
1955.....	819.9	4.99	628.5	3.83			37.4		.23				3.4	.02		28.2	.17		32.3	.20	
1956.....	844.5	5.05	641.3	3.83			35.7		.21				3.4	.02		27.5	.16		33.5	.20	
1957.....	864.1	5.07	650.6	3.82			36.7		.22				3.3	.02		28.1	.17		34.0	.20	
1958.....	884.5	5.11	658.0	3.80			37.0		.21				3.9	.02		28.4	.16		39.7	.23	
1959.....	955.5	5.42	698.9	3.96			40.4		.23				4.4	.03		35.1	.20		42.4	.24	
1960.....	966.2	5.39	697.5	3.89			40.6		.22				4.9	.03		33.4	.19		45.2	.25	
1961.....	981.1	5.39	694.7	3.82			39.9		.22				4.5	.02		32.9	.18		48.0	.26	

consumption, and it occupies a greater percentage of the frozen dessert market than does the combined total of all other new products.

About 44 percent of all ice milk is sold in soft-frozen form. Extensive development of drive-ins and increasing popularity of soft-frozen desserts may account for much of the growth in consumption of this product.

Most soft-frozen desserts are sold through drive-in type establishments that make the dessert in a soft-serve machine and draw the product directly for the customer (see cover page). Soft-frozen products in 1961 amounted to 95.3 million gallons or about 10 percent of frozen dessert production exclusive of water ice. While a sizable 44 percent of the ice milk is sold in this form, only 5 percent of the mellorine, 4 percent of the milk sherbet, and 3 percent of the ice cream is sold in soft form. Of total soft-product gallonage made in 1961, ice milk accounted for 74 percent, ice cream for 21 percent, milk sherbet for 2 percent, and mellorine for 3 percent.

Milk sherbet at peak during World War II

In 1942, 8.8 million gallons of sherbet were produced. One year later, production had risen more than fivefold, and by 1945 it had reached an all-time high of 65.2 million gallons.

This tremendous wartime surge in sherbets was brought on by the shortage of milk solids. Requiring only half the butterfat and milk solids needed for ice cream, sherbets essentially filled the gap left by limited ice cream production. After the restrictions were removed in 1945, sherbet production dropped abruptly, almost to the prewar level.

Since the early postwar period, sherbet production has increased significantly, and per capita consumption is now over three times that of 1947. In spite of this increase, however, sherbet is not a product of major importance within the industry.

Other frozen desserts

Dairy items other than ice cream, ice milk, and sherbets comprise a very minor part of the frozen dessert market. Their gallonage has been on a general decline since the early 1950's, and per capita consumption is now down to one of the lowest volumes since production data on these items were first recorded in 1940.

Production of water ices has been maintained at a stable level since 1952. These products are primarily novelty items, and as such they do not appear to be highly competitive with the other frozen desserts.

Table 2. — Production of Ice Cream and Mellorine, and Proportion Mellorine Production Was of Ice Cream-Mellorine Production, United States and 12 Permitting States, 1952-1961

Year	United States			12 permitting states		
	Ice cream	Mellorine ^a	Percent mellorine	Ice cream	Mellorine	Percent mellorine
	1,000 gallons			1,000 gallons		
1952.....	592,705	11,188	1.85	77,641 ^b	11,188 ^b	12.59
1953.....	605,051	24,207	3.85	136,074 ^c	24,207 ^c	15.10
1954.....	596,821	31,379	5.00	131,471	31,371	19.26
1955.....	628,525	32,261	4.88	138,993 ^d	32,232 ^d	18.82
1956.....	641,333	33,473	4.96	146,341	33,326	18.55
1957.....	650,583	34,161	4.99	157,359 ^e	34,002 ^e	17.77
1958.....	658,026	39,690	5.69	159,926	39,485	19.80
1959.....	698,931	42,399	5.72	168,208 ^f	41,973 ^f	19.97
1960.....	697,552	45,214	6.09	170,113	44,473	20.72
1961.....	694,712	48,025	6.47	167,589	47,319	22.02

^a Includes gallonage produced in all 15 states.

^b Illinois, Missouri, Oklahoma, and Texas.

^c Add Alabama, Arkansas, California, Montana, and Oregon.

^d Add South Carolina.

^e Add Louisiana.

^f Add Arizona.

Mellorine

Mellorine is something of a paradox. It is contributing substantially to the expansion of the frozen dessert market, but it is of concern to the dairy industry because vegetable fat rather than butterfat is used in its manufacture. At present it is made and sold in 12 states.¹

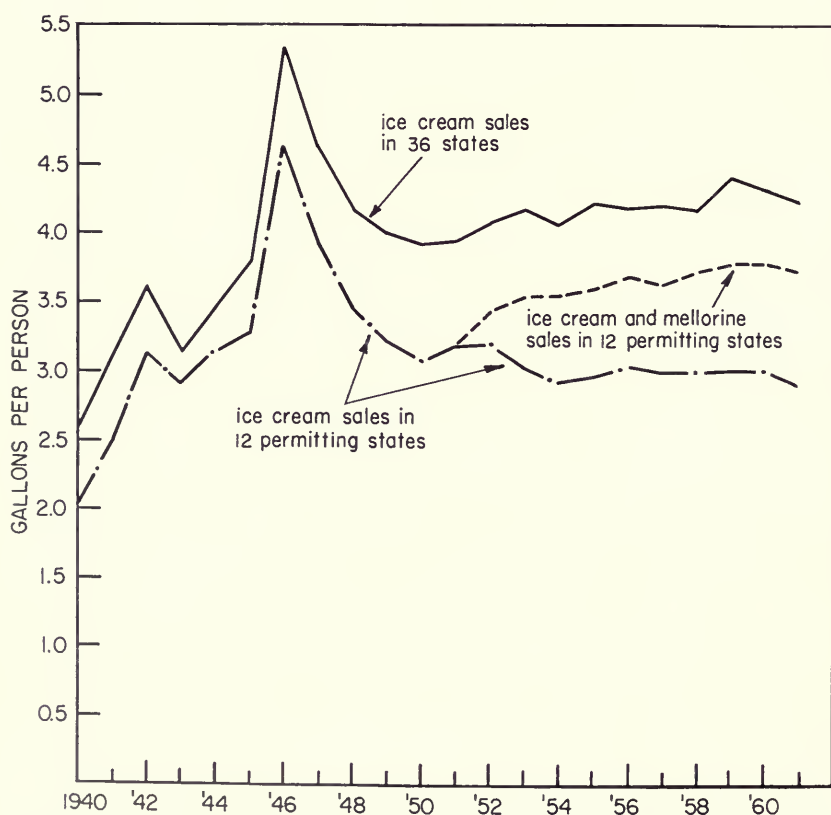
When mellorine production data were first reported, in 1952, only Illinois, Missouri, Oklahoma, and Texas allowed the product. Alabama, Arkansas, Montana, and Oregon legalized mellorine production in 1953, and California changed a legal interpretation to allow the product that same year. South Carolina produced in 1955, Louisiana in 1957, and Arizona in 1959.

Mellorine production has grown steadily as the states were added and this product now commands more than 22 percent of the ice cream-mellorine market in the 12 permitting states (Table 2). For purposes of comparison it is assumed that the product is consumed within the state that produced it.

¹ Actually mellorine is manufactured in three additional states. In one of these states, unnamed, mellorine production is illegal. In the other two, Nevada and Indiana, beginning production in 1954 and 1956, respectively, production is on such a small scale that state figures are withheld to avoid disclosure of individual operations. Gallonage produced in these three states is included in United States totals. In this bulletin, however, most of the discussion on mellorine is concerned with conditions in the 12-state area only.

Per capita ice cream consumption in these 12 states is now 31.8 percent below that in the 36 nonpermitting states. It should be noted, however, that even during the 12 years prior to the appearance of mellorine (1940-1951), per capita consumption of ice cream averaged 15.8 percent below that in the nonpermitting areas (Fig. 4). Since mellorine has established itself in the marketplace, the combined total of per capita ice cream and mellorine consumption in permitting states is still below the figures for the remaining states. The difference is about 12.3 percent.

Situations in individual mellorine states, of course, differ from the total picture (Table 3). Mellorine production has grown slowly and steadily in most of the states but has been declining in Illinois since 1953 and in Oklahoma since 1956; in California it has risen rapidly



Per capita ice cream and mellorine sales in mellorine-permitting and non-permitting states. (Fig. 4)

Table 3. — Mellorine Production by States, 1952-1961

State	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
					1,000 gallons					
Alabama.....	...	56	144	458	511	420	429	483	448	445
Arizona.....	...	...	...	...	...	...	...	73	318	487
Arkansas.....	...	166	329	524	615	622	623	735	922	971
California.....	...	1,130	2,260	2,070	2,672	3,759	7,691	9,358	10,774	12,846
Illinois.....	2,459	5,300	4,681	4,394	4,121	3,630	3,300	3,119	2,722	2,382
Louisiana.....	...	...	...	...	...	124	364	473	708	945
Missouri.....	1,780	2,493	2,973	2,542	2,298	2,982	2,917	3,154	3,236	3,036
Montana.....	...	79	124	159	227	314	389	374	319	316
Oklahoma.....	542	2,215	2,927	3,069	3,096	2,875	2,909	2,850	2,779	2,801
Oregon.....	...	261	298	368	363	411	429	639	734	736
South Carolina.....	...	...	...	(a)	(a)	(a)	(a)	162	163	188
Texas.....	6,407	12,507	17,635	18,648	19,423	18,865	20,434	20,553	21,350	22,166
U. S. total.....	11,188	24,207	31,379 ^b	32,261 ^b	33,473 ^b	34,161 ^b	39,690 ^b	42,399 ^b	45,214 ^b	48,025 ^b

^a Not reported when less than three plants.^b Includes gallonage produced in states for which individual figures are not reported.

since 1957. Texas, which has 20 years' experience with mellorine, now produces more mellorine than ice cream, and Texas' mellorine gallonage is nearly half of total mellorine production.

Factors Associated With Higher Per Capita Sales of Frozen Desserts

The fact has been shown that per capita consumption of all frozen desserts has expanded substantially during the past 30 years, and particularly since 1950. Factors contributing to this increase are generally thought to include increased income, lower unit costs and unit prices, improved packaging, improved merchandizing, greater availability through food stores and year-round sales, and improved uniform quality.

Income

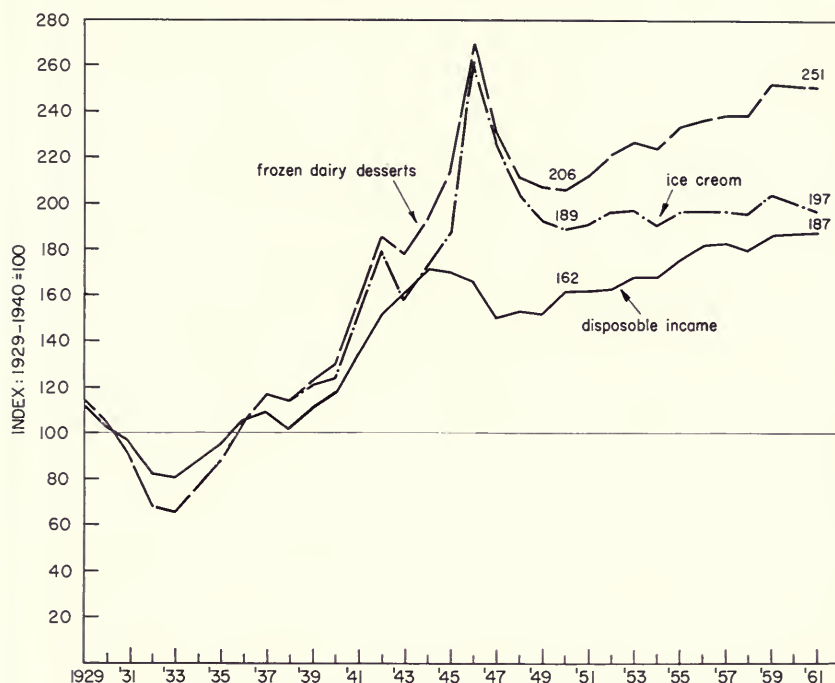
During the depression of the early 1930's, frozen dairy products suffered a decline much greater than any other major dairy product. Ice cream, which at that time accounted for about 99 percent of the frozen dessert market, decreased 41 percent in per capita consumption between 1929 and 1933. In 1932 cheese dropped 4 percent, and by 1934 fluid milk had dropped 5 percent, but no other major dairy item came any closer to the 41-percent figure. This situation suggests that the relation between per capita disposable income and per capita consumption would be high.

Correlation analysis for the 1930-1960 period provides the following estimates of the income-consumption relationship:

$$\begin{array}{ll} b = .0036 & r^2 = .9105 \\ E_{income} = 1.2695 & r = .9542 \end{array}$$

The coefficient of determination (r^2) indicates that over 91 percent of the variation in ice cream consumption was directly associated with changes in income. The b value indicates that with every \$100 change in income, ice cream consumption will change by just over one-third of a gallon in the same direction. Ice cream consumption is apparently quite responsive to changes in income. The income elasticity coefficient indicates that ice cream consumption will change by 1.27 percent for each 1-percent change in income in the same direction.

While the overall correlation has been high, in recent years the relation between income and consumption of frozen dairy desserts has changed significantly (Fig. 5). Since 1950 the consumption rate of frozen dairy desserts has increased considerably faster than per capita



Per capita consumption of frozen dairy desserts and ice cream, and per capita disposable income, United States. (Fig. 5)

disposable income. This suggests that factors other than income may have been contributing more than previously to the growth in the market for frozen desserts.

Price

Studies have indicated that ice cream consumption has been relatively responsive to changes in price. One study using consumer-panel data has estimated a price elasticity for ice cream of $-.86$.¹ In another study, the results of several different analyses point toward an elasticity approximating -1.2 .² From these coefficients, one may generalize that a 1-percent change in the price of ice cream is associated with approximately a 1-percent change in consumption in the opposite direction.

¹ Quackenbush, G. G. and H. H. Homme, Factors Affecting Purchases of Ice Cream for Home Use, Mich. State Agr. Exp. Sta. Tech. Bul. 249, p. 14. 1955.

² Rojko, A. S., The Demand and Price Structure for Dairy Products, USDA Tech. Bul. 1168, p. 163. 1957.

Lower unit costs

An additional important factor associated with higher per capita consumption of frozen desserts is that of lower unit costs. The fact has been shown that the volume of ice cream per plant is now more than six times that of about 25 years ago. Lower unit costs associated with large volume per plant have been supplemented by increased automation. Unit costs of production are materially lower than formerly. In addition to economies of scale and automated packaging, improved merchandizing techniques have resulted in a greatly increased volume per store. This, in turn, has lowered unit costs for marketing and has made possible lower retail prices.

In addition, the marked growth in sales of ice milk and mellorine indicates that these items are substituting for ice cream to some extent, and it is likely that lower cost per unit is a factor.

Ice milk, because of its lower butterfat content, can be sold at a lower retail price than ice cream. The difference between fat costs for 4-percent ice milk and 10-percent ice cream averaged 10.75 cents a half-gallon or 2.69 cents a pint during the ten-year period 1952-1961.¹ The difference between 4-percent ice milk and 12-percent ice cream has been 14.34 cents a half-gallon or 3.58 cents a pint.

Also, the butterfat used in ice cream still costs about 15 cents more per half-gallon than the fats used in mellorine manufacture, and this cost difference continues to be reflected, at least partially, in retail prices.²

New low-calorie desserts

Most of the newer frozen desserts, which accounted for 28 percent of sales in 1960, have a lower fat content than ice cream. A 100-gram serving of ice cream contains about 200 calories; mellorine, 180 calories; ice milk, 160; sherbet, 140; fruit ice, 130.³ Presumably, the

¹ Butterfat prices, based on Boston cream and Chicago 92-score butter prices, averaged 79.67 cents a pound during the 1952-1961 period.

² The 15-cent figure is calculated on the basis that most of the mellorine (85 percent) is manufactured with either cottonseed oil or soybean oil as the fat constituent. The average of the costs of these two oils was 18.19 cents a pound during the 1952-1961 period. The fat-cost difference between a 2.25-pound half-gallon of 10-percent ice cream and an equal-weight half-gallon of 8-percent mellorine averaged 14.65 cents for the ten-year period.

³ Calorie counts for products with the following characteristics: ice cream, 10.1 percent fat and 39.4 percent total solids; mellorine, 10 percent fat and 39.3 percent total solids; ice milk, 4.1 percent fat and 34.9 percent total solids; sherbet, 1.5 percent fat and 35.0 percent total solids; fruit ice, 23 percent sucrose, 9 percent glucose, 2 percent orange flavoring, 0.5 percent stabilizer, and 0.125 percent citric acid.

increased consumption of the newer products is associated with the fact that many people are calorie conscious, and the lower-calorie desserts, from their viewpoint, are desirable.

The preference for the lower-calorie dessert is in keeping with the significant trend away from the higher-fat dairy products in recent years. Per capita consumption of milkfat has declined from a 1935-1939 average of 31.7 pounds to 24.0 pounds in 1961. For the same years consumption of nonfat solids increased from 39.6 pounds to 43.7 pounds per capita.

Improved uniform quality

Technological advances such as continuous freezing of the product, better understanding of colloidal gums, and greater efficiencies in heating, homogenizing, and hardening processes have improved the body and texture of frozen desserts. Flavor has been improved by new and better flavoring materials and by the prevention of off-flavor through such methods as improved sanitation of raw milk on the farm.

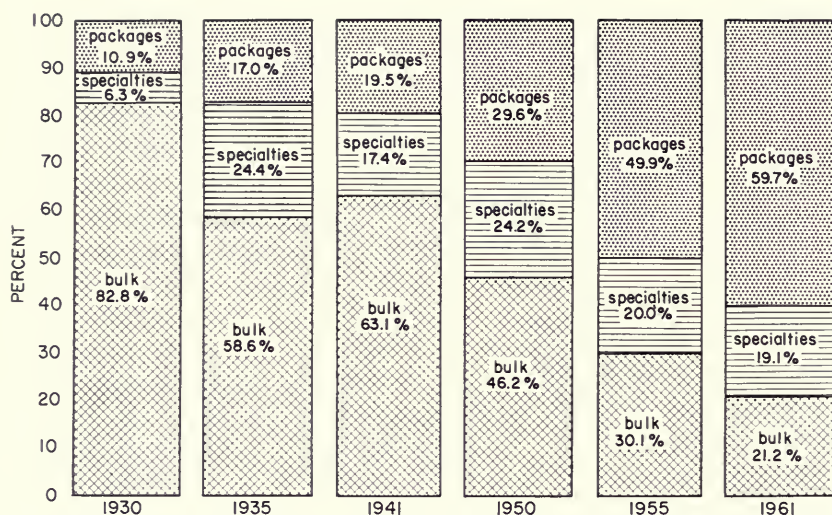
In addition, the use of laboratory controls has made possible a greater degree of compliance with standards of composition and sanitation. Because of large volume per plant, this has been achieved at a relatively low unit cost.

These and other developments have resulted in frozen desserts that consumers can buy with assurance of improved and more uniform quality.

More and bigger packages

Two major changes in packaging of frozen desserts have taken place in recent years. First, the proportion of the desserts sold in bulk form has declined markedly while the proportion sold in packages — pints, quarts, half-gallons, and gallons — has increased. The percentage of bulk sales is now only about one-fourth the level of 30 years ago (Fig. 6). On an absolute basis, however, bulk sales have remained relatively stable in the 200-million- to 300-million-gallon range over the entire period. Meanwhile, package sales have increased to the point where they now account for more than half of the frozen dessert gallonage sold.

The second major change is the establishment of the half-gallon as the primary container size. In the 1940's, most of the gallonage sold in packages was in pints, and this situation continued through 1950, when pint sales accounted for 19.0 percent of total frozen dessert sales. In that year quart sales were 5.8 percent of the total, and gallons and half-gallons together accounted for only 4.8 percent. Shortly there-



Proportions of frozen dessert gallanage sold as bulk, in packages, and as specialties items, United States. (Fig. 6)

after, however, the shift to the larger package size appeared and progressed rapidly. By 1955, 28.0 percent of frozen dessert gallanage was being sold in gallons and half-gallons; in 1961 the figures were 43.4 percent for half-gallons and 2.9 percent for gallons. The percentage sold in pints has declined considerably (17.8 percent in 1955 and 9.4 percent in 1961) while the reduction of quart sales (4.1 percent in 1955 and 3.5 percent in 1961) has been less drastic. Half-pint packages accounted for 0.5 percent of 1961 sales.

It is notable that mellorine is ahead of the overall frozen dessert industry in packaging trends that are contributing to the growth of sales. In 1955, 59.1 percent of the mellorine was sold in gallon and half-gallon containers, 18.1 percent in quarts, 8 percent in pints, only 6.7 percent in bulk, and less than 10 percent in novelties and cups. Much of this situation probably is due to the fact that most mellorine-permitting states provide that the product may be sold only in packages of a half-gallon or less, the reasoning being that the risk of fraudulent substitution is greatest when the product is bulk dispensed.

Consumer acceptance of the larger package size has been influenced by two factors: price and refrigeration. Probably the more important is improved home refrigeration, which makes it possible for the consumer to buy less frequently and in larger quantities and to store the

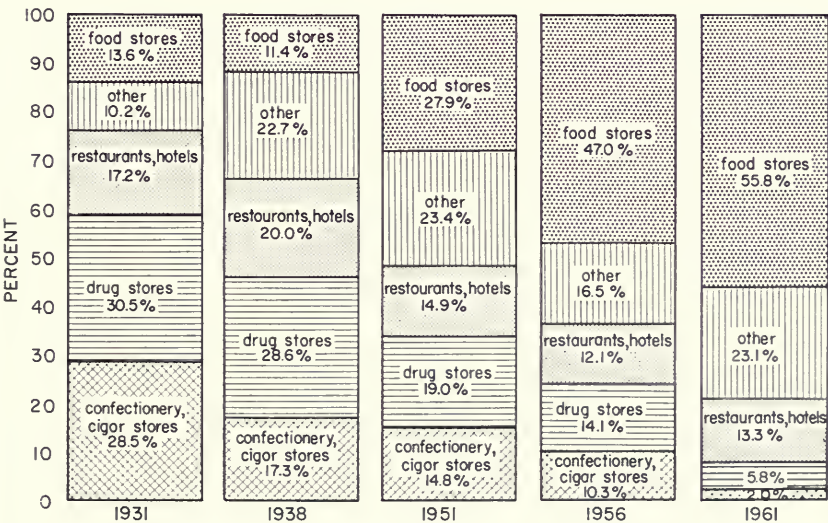
product at below-zero temperatures. Combined with this is the lower price for the larger package.

Frozen desserts packaged as novelties and specialties or in cups have always accounted for a significant proportion of the market. Vending machines have contributed substantially to maintaining their popularity. In 1958, 31,700 vending machines in the United States sold \$23 million worth of these products, each machine selling about 147 items per week.

Greater availability through food stores and year-round sales

The greater availability of frozen desserts is seen in the shift in retail sales outlet, which occurred concurrently with the increase in package sales. The major changes since 1930 are the increase in the proportion of frozen desserts sold through food stores and the accompanying decrease in the proportion sold through drug stores and confectionery and cigar stores (Fig. 7). The proportion sold in restaurants and hotels has fluctuated since 1930, but the overall trend has been downward.

During the past decade there has been a large increase in the number of dairy drive-ins, which sell ice milk, primarily. This expansion

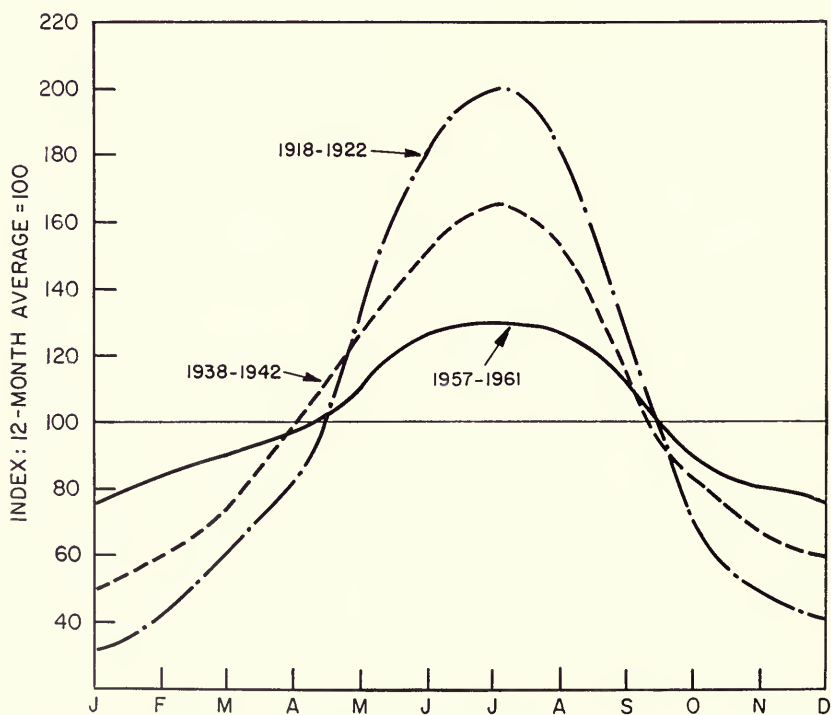


Proportional distribution of frozen desserts through major sales outlets, United States. (Fig. 7)

has opened up a new market for frozen dairy desserts. The fact that food stores are by far the major outlet, however, suggests that consumers now regard frozen desserts as a standard, as well as an occasional, food item and this thesis is supported by the decreasing seasonality of frozen dessert sales.

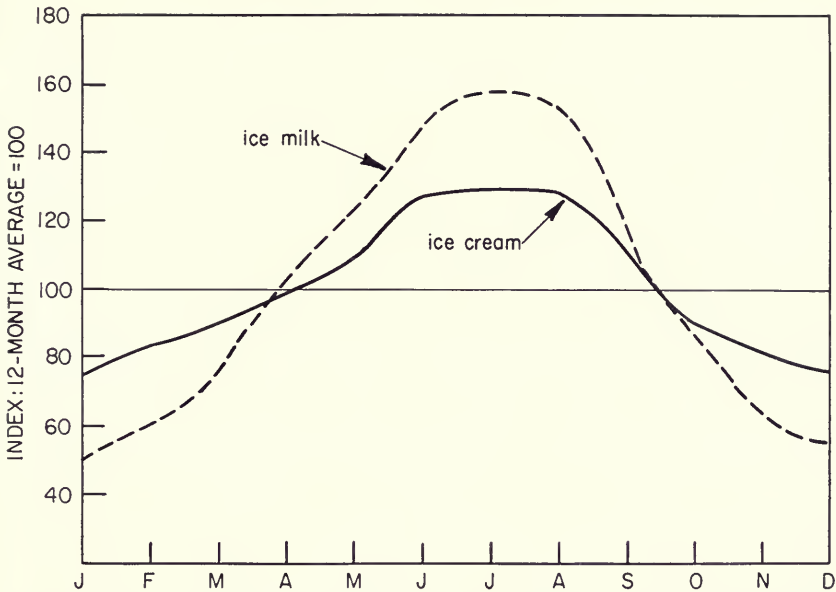
There is a direct relation between mean temperature and per capita sales. The increase in sales during higher temperature periods is frequently associated with purchasing by a larger percentage of all consumers, not merely more buying by year-round customers. Indications are, however, that there are more year-round customers now than previously.

Production and consumption are lowest in January and highest in July, but the difference is now far smaller than in previous years (Fig. 8). During the 1918-1922 period, July consumption of ice cream was 5.5 times that of January. In 1938-1942 it was 3.3 times, and in 1957-1961 it was 1.7 times.



Seasonality of ice cream production, United States.

(Fig. 8)



Seasonality of production of ice cream and ice milk, United States, 1957-1961. (Fig. 9)

The seasonality of ice milk (Fig. 9) is considerably greater than that of ice cream, and this may be due to the fact that many ice milk stands are closed in winter months. As the volume of store sales of ice milk expands, it is probable that the seasonality of its sales will tend to decrease.

Summary

1. Frozen dairy products are using an increasing proportion of the total milk supply in the United States. This has resulted from an increase in per capita sales and from a net decrease in the amount of milk per person formerly used in other dairy products.

2. Per capita sales of frozen dairy desserts have increased more since World War II than have those of any other major dairy product. In 1961 the index of frozen dairy dessert sales in the United States was 251; cheese, 167; fluid milk, 104; fluid cream, 87; evaporated milk, 78; and butter, 43 (base period 1924-1940 = 100).

3. Ice milk has become the most important of the new frozen dessert items. Its share of the total market has increased from 3.1

percent in 1940 to 5.8 percent in 1950 and 15 percent in 1960. A lower retail price, a lower calorie content, and wide availability have helped to bring about the substantial increase in per capita sales of ice milk.

4. In 1960 other new dessert products, including mellorine (4.6 percent), sherbet (4.2 percent), water ice (3.5 percent), and other products (0.5 percent), accounted for 12.8 percent of the total frozen dessert gallonage produced.

5. Twelve of the 48 states (excluding Alaska and Hawaii) currently report the sale of mellorine. Prior to the innovation of mellorine, ice cream sales in the 12 permitting states from 1940 to 1951 averaged 3.20 gallons per person annually or 15.8 percent less than in the 36 nonpermitting states (3.80 gallons). With increased mellorine sales, sales of ice cream in the 12 permitting states had declined to 2.89 gallons per person in 1961. This was 31.8 percent below the average ice cream consumption in the other 36 states.

6. Sales of mellorine in the 12 permitting states increased from 0.23 gallon per person in 1952 to 0.83 gallon in 1961. When combined with ice cream sales in these states (2.89 gallons per person) total sales of ice cream and mellorine in 1961 were 3.72 gallons per person. This total was only 12.3 percent less than the average per capita sales of ice cream in the 36 nonpermitting states in 1961 (4.24 gallons).

7. Factors which encouraged a higher per capita consumption of frozen desserts were:

a. Increased purchasing power of consumers. Sales of frozen dairy desserts tend to change with a change in consumer income. Thus from 1929 to 1960 (excluding war years) the coefficient of correlation between per capita sales of frozen dairy products and per capita disposable income was .954. Since 1940, per capita purchasing power has been substantially above that for earlier years.

b. Lower unit costs and unit prices. Lower unit costs are associated with larger volume per plant, automated packaging, and improved merchandizing techniques which have resulted in increased volume per store.

c. Introduction of new, low-calorie substitutes for ice cream. In 1930 negligible amounts of desserts other than ice cream were sold. In 1960, 28 percent of frozen desserts were new products; these included ice milk, sherbet, mellorine, and water ice, all of which usually have a lower fat content and a lower calorie content than ice cream.

d. Improved uniform quality. Advances in processing, improvement of ingredients, and laboratory controls have contributed to improved and more uniform quality of frozen desserts.

e. Improved packaging. Formerly a substantial proportion of ice cream was sold in bulk form; at present an increasing proportion of frozen desserts is packaged in cartons that are sold through stores. In 1925 only 12 percent of frozen desserts were plant-packaged for consumers. By 1961 this proportion had increased to 60 percent. Associated with this are new and better merchandizing techniques.

f. Greater availability. This is associated with sales of dairy desserts in food stores throughout the year. From 1918 to 1922 July sales for ice cream were 5.5 times those in January; from 1957 to 1961 July sales were only 1.7 times those in January. Also, the growth in the number of dairy drive-ins has greatly increased the availability of frozen dairy desserts.

Outlook for Frozen Dairy Products

A paper recently presented¹ stated: "Probably the most important factor running through all types of business — the firm, the store, the farmer cooperative, and similar institutions — is *maintaining high quality for products that consumers want — at a low price. In essence, this is the key to survival.*" In no major segment of the dairy industry is this principle better illustrated than in the frozen dessert industry.

One example of this is ice cream packaged in the ice cream plant and sold through food stores. Mass production combined with automation and mass distribution has substantially reduced unit costs. With intensive competition of food stores in most parts of the United States, lower unit costs have been passed on to consumers in a lower price. The lower price, in turn, combined with improved refrigeration, has encouraged the year-round use of frozen dairy desserts. Increased sales also have been associated with high quality.

Another example is the large expansion in the sale of ice milk, both in drive-ins and in stores. In an age of the declining value of money, in some places a nickel still buys a good-sized cone of ice milk. The large number of automobiles around an ice milk stand on a hot night and the people lined up at the sales windows are good evidence that the frozen dessert industry has made a product that consumers want, and that it is being sold at a price consumers can afford.

¹ Bartlett, R. W., "Survival in an age of change." Univ. Ill. Dept. Agr. Econ. Bul. No. 5, p. 8. 1962.

A significant factor in the outlook for the frozen dessert industry, and one that may become important, is the growth in sales of mellorine. With the possibility that more states will permit its sale, what effect is this likely to have upon per capita sales of frozen desserts?

Three possibilities suggest themselves concerning the future of frozen dairy desserts within the next decade or so. In the first place, it is probable that more states will permit the production and sale of mellorine. And presumably per capita sales of frozen dairy desserts may be reduced somewhat by this event. On the other hand is the fact that in some states such as Illinois, per capita sales of mellorine have declined in recent years. This situation has resulted in part from increased competition of ice cream and in part from competition of ice milk, for which unit costs of production and sale are low. Hence, while increased competition of mellorine is a probability, aggressive competition of those producing and selling frozen dairy desserts is likely to modify the competitive effects of mellorine in the market for frozen dairy desserts.

In the second place, the present trend is to produce ice cream with a lower butterfat content. This results in a lower unit cost of the ice cream and less difference between its cost and the unit cost of mellorine. The reduction of ice cream fat content is a sound one and for the country as a whole should make possible further increases in per capita sales of ice cream.

Finally, the sharp growth in the sales of ice milk, particularly between 1950 and 1960, augurs well for the continued expansion of this segment of the frozen dessert industry. In terms of milk equivalent, it is not impossible that within another decade, the proportion of ice milk to total milk used in the frozen dessert industry might be doubled.

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